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Notes on the *Bittacus* (Mecoptera, Bittacidae) of Mozambique, with the description of a new species

John M. Midgley[1,2], Terence A. Bellingan[2,3]

1 *KwaZulu-Natal Museum, Department Natural Sciences, 237 Jabu Ndlovu Street, Pietermaritzburg, 3201, KwaZulu-Natal, South Africa* **2** *Department of Zoology and Entomology, Rhodes University, Makhanda, 6139, Eastern Cape, South Africa* **3** *Albany Museum, Department of Entomology and Arachnology, 40 Somerset Street, Makhanda, Eastern Cape, South Africa*

Corresponding author: John M. Midgley (johnmidge@gmail.com)

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Abstract

A new species of *Bittacus* Latreille, 1805 is described based on two specimens from Gorongosa National Park in Mozambique. *Bittacus londti* **sp. nov.** is the second known Afrotropical *Bittacus* with a femoral bulla and brings the number of species known from Mozambique to four. A distribution map for these species is provided.

Keywords

Biodiversity, distribution records, hangingflies

Introduction

The order Mecoptera is a relatively small group of insects, represented by a single family in the Afrotropics, the Bittacidae. There are currently three genera in the region, the monotypic *Anomalobittacus* Kimmins, 1928 and *Afrobittacus* Londt, 1994 and the remaining 51 species in the cosmopolitan *Bittacus* Latreille, 1805. While *Bittacus* can be common, adults often only fly for short periods, meaning that many regional lists underestimate the true species richness and so opportunities for expanding our knowledge exist in many regions.

Most studies on Afrotropical *Bittacus* are historical (see Londt 1972a, b, 1978, 1981, 1993, 1994, 1995, 2001; Londt and van Noort 1999) and modern descriptions are needed. Recently, new Bittacidae have been described from the Neotropical (Machado 2019) and the Oriental (Tan and Hua 2009a, b; Zhang et al. 2020) regions. Our knowledge of the Afrotropical fauna is likely to be incomplete, and collecting is likely to generate new distribution records and undescribed species.

To date, only three species of *Bittacus* (*Bittacus nebulosus* Klug, 1938, *Bittacus weelei* Esben-Petersen, 1913 and *Bittacus zambezinus* Navás, 1931) (Fig. 1) have been positively recorded from Mozambique (Londt 1972b, 1994; Londt and van Noort 1999). This number is fewer than most surrounding countries (Tanzania: nine, Malawi: eight, Zambia: five, Zimbabwe: eight, South Africa: 21) (Londt 1994), suggesting that Mozambique offers significant opportunities for further research.

We describe a new species of *Bittacus* from the Afrotropics, based on male and female specimens from Gorongosa National Park, Mozambique.

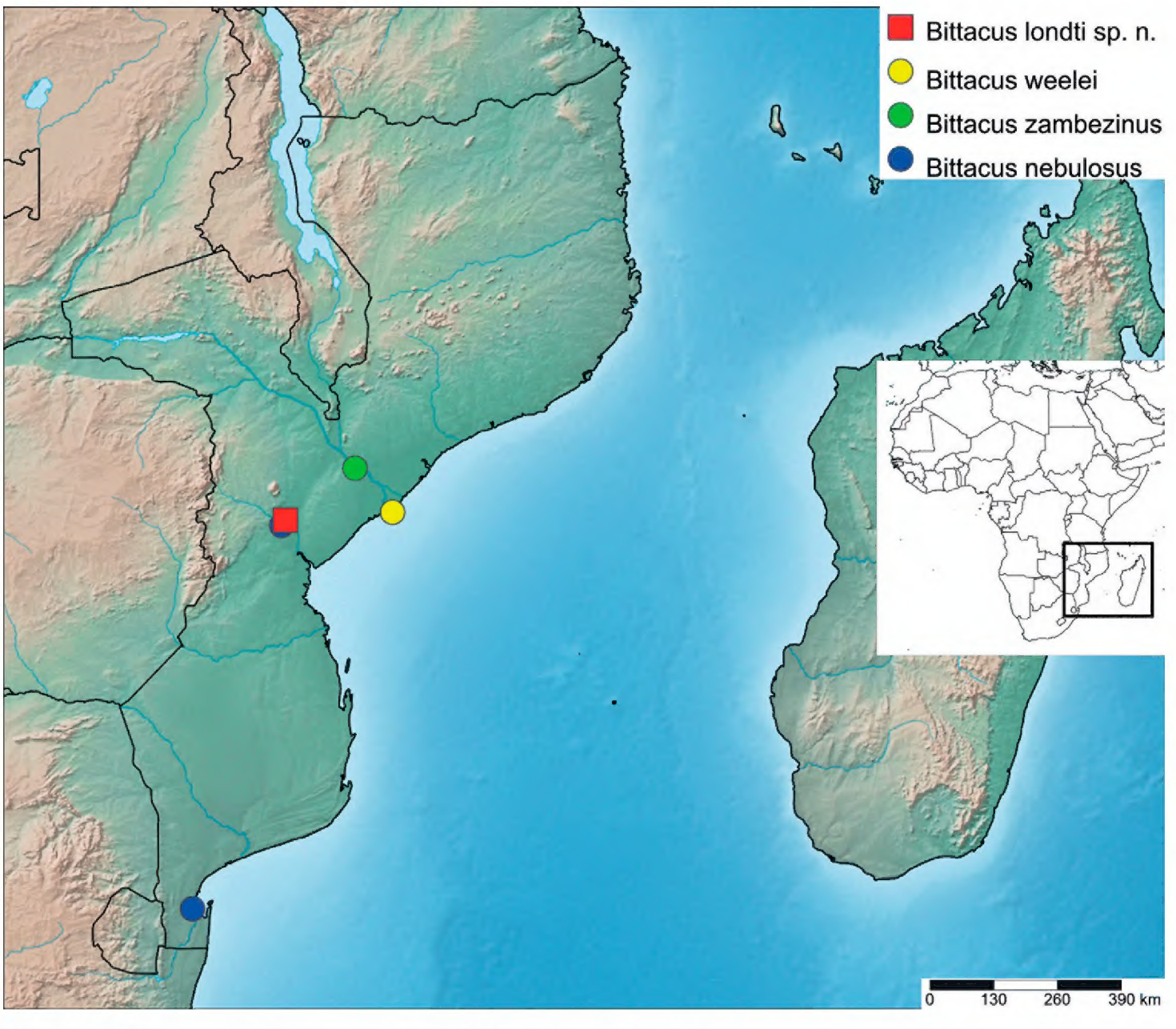

Figure 1. Known distribution records of Mozambican *Bittacus*.

Materials and methods

Study material

Material from the new species was obtained from the Iziko South African Museum, Cape Town, South Africa (**SAMC**). Comparative material from the KwaZulu-Natal Museum, Pietermaritzburg, South Africa (**NMSA**) was also studied.

Morphology

Terminology mostly follows Willman (1983). Morphological observations were made using a Leica M80 stereomicroscope. Digital images of the whole specimen were captured using a CANON 600D with a 100 mm macro lens. The open source software Digicam Controller (http://digicamcontrol.com/) was used to take images across the depth of field of the specimens. Images of the genitalia were captured using a Zeiss Axio Zoom.V16 microscope with an AxioCam ICc 5 camera and Zeiss Zen 2.3 Software. The images were stacked using Helicon Focus stacking software (https://www.heliconsoft.com) and edited in Adobe Photoshop 22.1.1. Line drawings of the wing venation were made in Adobe Illustrator 26.3.1. As the forewings of the holotype are damaged from being stored in ethanol, a composite of both wings was drawn.

Distribution records

Published records were obtained from the literature (Londt 1972b, 1994; Londt and van Noort 1999). The Global Biodiversity Information Facility (www.gbif.org) and iNaturalist (https://www.inaturalist.org/) were checked for additional records from Mozambique. The distribution map was prepared using the website SimpleMappr (www.simplemappr.net) and edited in Adobe Photoshop 22.1.1.

Results

Taxonomy

Bittacus Latreille, 1805

Bittacus Latreille, 1805: 20. Type species: *Panorpa italicus* Muller, 1766.
Leptobillacus Hine, 1898: 108. Type species: *Bittacus strigosus* Hagen, 1861.
Diplostigma Navas, 1908: 413. Type species: *Bittacus sinensis* Walker, 1853.
Haplodictyus Navas, 1908: 413. Type species: *Haplodictyus pobeguini* Navas, 1908.
Klugius Navas, 1926: Type species: *Bittacus flavescens* Klug, 1836.

***Bittacus londti* Midgley, sp. nov.**
https://zoobank.org/BF1BCB64-9873-4216-A315-964BD40EC0CA
Figs 2–10

Material examined. ***Holotype*** (Figs 2–5, 9, 10) Mozambique • 1 ♂; Sofala Province, Gorongosa National Park, Palm forest site 1, 18°59.518'S, 34°19.153'E; 40 m a.s.l.;10–20 Mar. 2017; S. van Noort & M. Buffington leg.; Malaise trap; Closed Palm Forest; Site code: GOR17-PALM1-M05; SAM-MEC-A000068.

Paratype (Figs 6–8) Mozambique • 1 ♀; Sofala Province, Gorongosa National Park, Palm forest site 1, 18°59.518'S, 34°19.153'E; 40 m a.s.l.;10–20 Mar. 2017; S. van Noort & M. Buffington leg.; Malaise trap; Closed Palm Forest; Site code: GOR17-PALM1-M05; SAM-MEC-A000069.

Diagnosis. *Bittacus londti* sp. nov. can be distinguished from other Afrotropical *Bittacus* (except *Bittacus bullatus* Londt, 1972b) by the bulla on the hind femur of males. The following characters permit differentiation from *B. bullatus*: *B. londti* has the femoral expansion situated more distally; a shorter pterostigma and smaller body size. Additionally, in the lateral view, *B. bullatus* has a pointed epandrium with a basodorsal projection (Londt 1972b fig. 23) while *B. londti* has a blunt epandrium without a basodorsal projection (Fig. 9). In the dorsal view, the epandrium is wide apically in *B. bullatus* (Londt 1972b fig. 24) and narrow in *B. londti* (Fig. 10). In the keys provided in Londt (1972b; 1978), this species keys as *Bittacus kunenensis* Wood 1933, but can be distinguished by the femoral bulla in the male.

Description. Measurements: Wing lengths: fore = 12.6 – 13.2 mm; hind = 11.5–11.8 mm.

Head (Figs 2–4, 6–8). Head light brown, except ocellar triangle dark brown to black; with yellowish pubescence, which is longer on the bottom half of the head and shorter above. Three distinct ocelli, lateral ocelli slightly larger (diameter approx. 1.15 times) than median. Antennae long, filiform, light brown with slightly darker pubescence. At least 15 flagellomeres in male (antennae broken), 18 in female.

Thorax (Figs 2–4, 6–8). Light brown on tergum, pale on pleuron and sternum, with yellowish pubescence. Antepronotum with one or two brown setae on lateral margins, postpronotum with yellow pubescence, but no setae. Mesonotum and metanotum with scutellum slightly paler, with scattered black setae. With ten small light brown setae and one large darker seta on basalare.

Legs (Figs 2–4, 6–8). Coxae pale, trochanters pale with dark margin to sulcus; with yellowish pubescence on both coxae and trochanters. Femur and tibia set with sparse short black setae. Femora pale, with dark apical tips. Fore- and mid- femur long, thin; hind femur in male with medial bulla with 16 to 18 short black setae. Tibia pale with dark apical tips, approx. as long as femora, with two long apical spurs; spurs about two thirds the length of the basitarsus in forelegs, about 3/4 the length of basitarsus in mid legs, one slightly shorter and one slightly longer than basitarsus in hind leg. Tarsi pale brown; male with fore- and mid- tarsi approx. the length of tibiae, hind tarsus slightly shorter length of hind tibia; female with all tarsi approx. the length of tibiae. Male tarsomere ratios: fore tarsus 5.1:2.0:1.4:1.1:1.0;

mid tarsus 5.5:2.5:1.7:1.3:1.0; hind tarsus 1.9:1.1:1.0:1.6:1.6; female tarsomere ratios: fore tarsus 4.9:2.1:1.3:1.1:1.0 mid tarsus 4.6:2.1:1.3:1.0:1.0 hind tarsus 3.8:1.3:1.0:1.7:1.7

Figure 2. Dorsal view of holotype male *Bittacus londti* sp. nov. (SAM-MEC A000068).

Figure 3. Frontal view of holotype male *Bittacus londti* sp. nov. (SAM-MEC A000068).

Wings (Figs 2–8). Narrow with apex rounded. Membrane pale brownish, pterostigma brown, 2.2 to 2.9 times longer than wide; thyridia present. Forewing: one subcostal crossvein; humeral crossvein present; Sc ending beyond first fork of Rs; Rs1+ 2 forking before end of pterostigma; Rs3+ 4 forking at level of mid distance between apex of Sc and pterostigma; one pterostigmal crossvein; M origin basal to Rs origin; M and Rs first forks at same level; Cu1 ending beyond apex of Sc; A1 ending level with origin of Rs. Hind wing similar to forewing, except Rs1+ 2 not forked in one wing on male, when present forking level with end of pterostigma; A1 ending beyond origin of Rs. In female, Rs3+ 4 forking closer to pterostigma than apex of Sc.

Abdomen (Figs 2–4, 6–8). Bearing yellowish pubescence. Pale brown, segments 1–3 with thin, dark apices.

Male terminalia (Figs 9, 10). pale brown, matching the abdomen, with yellowish pubescence. Epandrium in dorsal view: outer margins subparallel, inner margins evenly curved; internal margin with short brown setae on apical half; In lateral view: ending

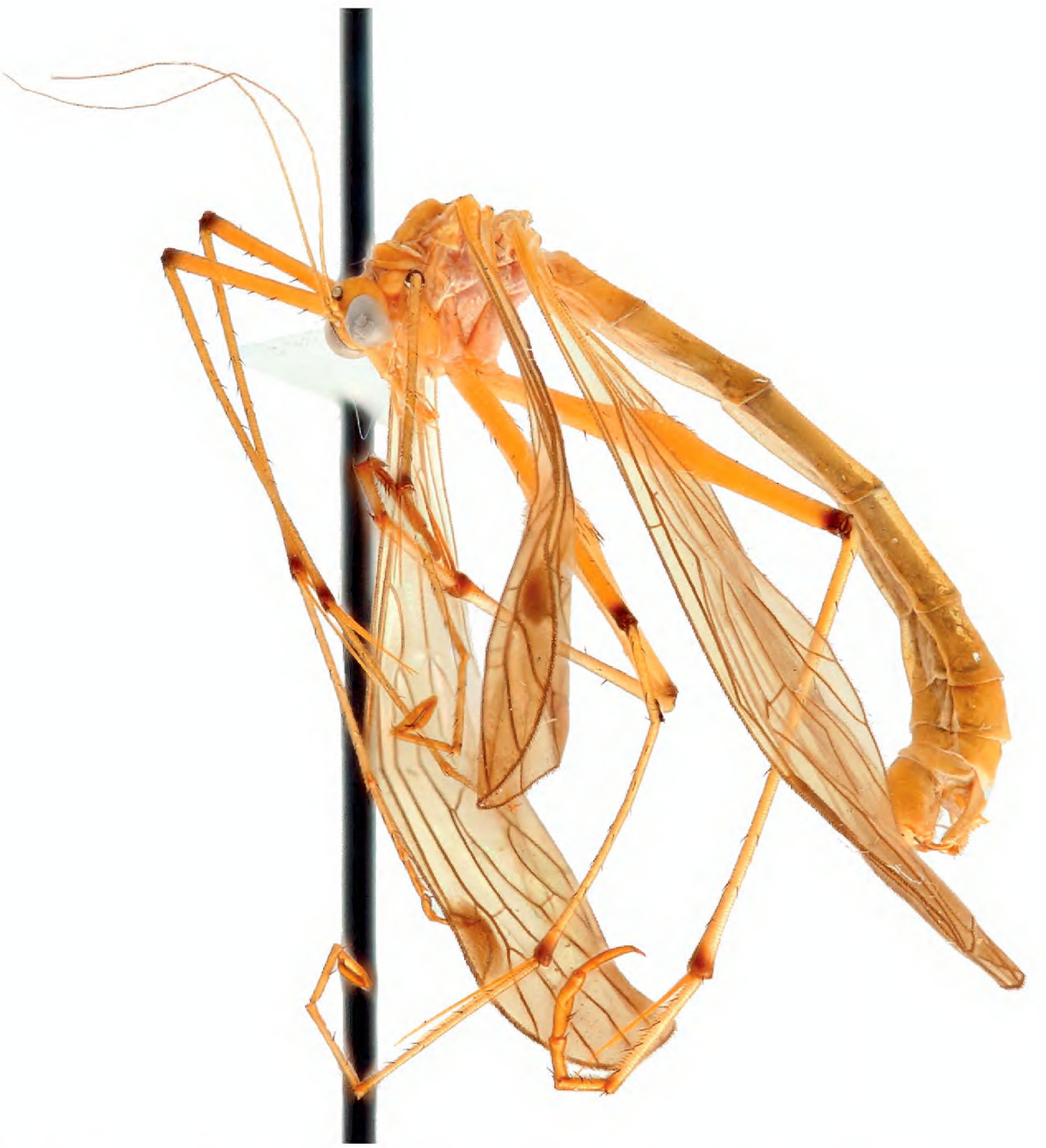

Figure 4. Lateral view of holotype male *Bittacus londti* sp. nov. (SAM-MEC A000068).

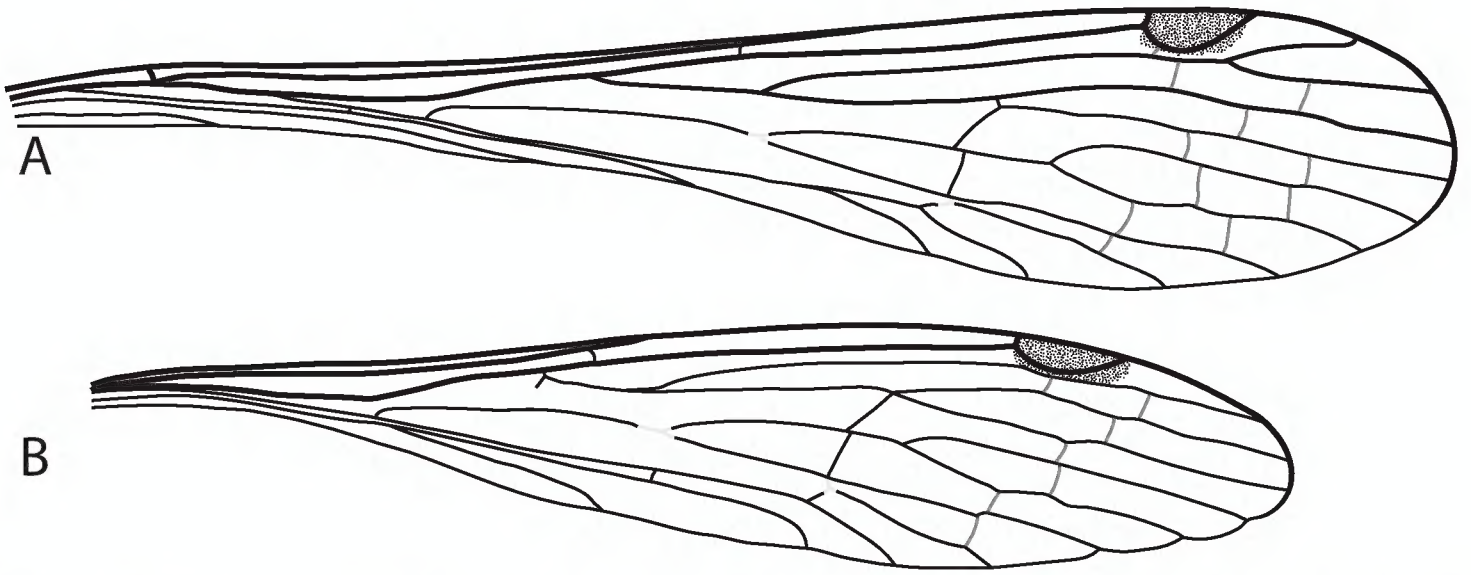

Figure 5. Wing venation of holotype male *Bittacus londti* sp. nov. **A** forewing, drawn from composite of left and right wing **B** left hindwing, digitally flipped. (SAM-MEC A000068).

Figure 6. Dorsal view of paratype female *Bittacus londti* sp. nov. (SAM-MEC A000067).

Figure 7. Frontal view of paratype female *Bittacus londti* sp. nov. (SAM-MEC A000067).

Figure 8. Lateral view of paratype female *Bittacus londti* sp. nov. (SAM-MEC A000067).

Figure 9. Dorsal view of the genitalia of holotype male *Bittacus londti* sp. nov. (SAM-MEC A000068).

Figure 10. Lateral view of the genitalia of holotype male *Bittacus londti* sp. nov. (SAM-MEC A000068).

level with end of basystilus; base and apex subequal in height, narrowed medially; dorsal corner of apical margin right angled, ventral corner rounded; in posterior view dorsal and ventral corners pointed internally, ventral point slightly larger, internal margin crescent shaped. Cercus approx. as long as sternite IX, light brown, with yellowish setae. Basystilus with yellowish pubescence, dorsal margin straight, ventral margin convex in lateral view. Gonostylus short, dark brown. Penisfilum broad at base, abruptly narrowed medially, tapering towards apex, curving backwards but not forming a complete coil.

Female terminalia. Cercus short, dark brown apically, with light brown setae. Subanal plate and tergite IX light-brown, with light-brown setae. Cercus, subanal plate extended beyond tergite IX. Gonocoxosternite light-brown, with light-brown setae which are darker near the posterior margin; fused ventrally.

Etymology. The species is named in honour of Dr Jason Londt, who has described over 25% of the Afrotropical Bittacidae, more than any other author.

Comments. The specimens were found in malaise trap samples and were mounted from ethanol. The wings are folded and legs could not be arranged neatly. The malaise trap was in a closed palm forest (Fig. 11).

Bittacus bullatus Londt, 1972

Material examined. South Africa • 2♂, 2♀; Mpumalanga, Sabie, Loerie Trail, Castlerock Camp area, 25°06'S, 30°46'E; 900 m a.s.l.; 07 Dec. 1997; J.G.H. Londt & A. Londt leg.; NMSA-Mec 000373, NMSA-Mec 000374, NMSA-Mec 000375, NMSA-Mec 000376

Bittacus testaceus Klug, 1838

Material examined. South Africa • 1♂; Mpumalanga, Sabie; -25.100566; 30.778525; 09 Jan. 1964; T.R.P. de Beer leg.; NMSA-Mec 000243

Species distributions

Bittacus londti is only known from the type locality (Fig. 1). The published Mozambican distribution records of *B. nebulosus*, *B. weelei* and *B. zambezinus* are shown in Fig. 1. No additional records from Mozambique were found on iNaturalist and a single record of *B. testaceus* was found on GBIF from "Sabie". The specimen is at the KwaZulu-Natal Museum and has been seen by the authors. The label has no country information. There are multiple specimens of other species with the same collector information (T.R.P. de Beer), all from South Africa. It therefore seems more likely that this record refers to the town of Sabie in Mpumalanga province, South Africa and not Sábiè in Província de Maputo, Mozambique. This agrees with Londt (1972b), who listed the Sabie record under "Transvaal".

Figure 11. In situ photograph of the malaise trap at the collection site and habitat of *Bittacus londti*. Photograph ©Simon van Noort (Iziko Museums of South Africa).

Discussion

The description of *B. londti* brings the number of *Bittacus* recorded from Mozambique to four and the number in the Afrotropics to 52. This is still a relatively low number for a country as large and diverse as Mozambique, and further collecting will almost certainly increase the number of species known from the country. Given this uncertainty, the keys provided by Londt (1972b, 1978) are still the most useful identification guides to the Mozambican *Bittacus* fauna, as augmented here.

While *B. londti* keys as *B. kunenensis* in these keys, confusion is unlikely as *B. kunenensis* is only known from northern Namibia and *B. londti* has an unmistakable femoral bulla. *Bittacus bullatus* has been recorded in South Africa about 100 km from Mozambique (though more than 700 km from Gorongosa) but confusion is unlikely as there are multiple morphological differences. The femoral bulla in *B. londti* and *B. bullatus* is without doubt an intriguing feature but it is unclear what role it plays in the biology of these species. Until further information comes to light suggestions on the utility of the bulla are speculative.

Beyond new country records and undescribed species, increased collecting in Mozambique will provide distribution information for the recorded species. To date, the four species known from Mozambique are known from only five collecting events (Fig. 1), clearly showing gaps in the knowledge of Mozambican *Bittacus*.

The suggestion that *B. testaceus* might occur in Mozambique (Londt 1994) was probably based on material from 'Sabie' a place name occurring both in South Africa and Mozambique (Londt pers. comm.). The record on GBIF appears to be an error, and until material confirming the presence of this species in Mozambique has been collected, *B. testaceus* should not be included in the Mozambican fauna.

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